IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL INC.; and HONEYWELL INTELLECTUAL PROPERTIES INC.; Plaintiffs, v. APPLE COMPUTER, INC., et al. Defendants.	Civil Action No. 04-1338 JJF (Consolidated) **PUBLIC VERSION**

DECLARATION OF ELLIOT SCHLAM IN SUPPORT OF DEFENDANTS FUJIFILM CORPORATION, FUJIFILM U.S.A, INC., OPTREX AMERICA INC., SAMSUNG SDI CO., LTD. AND SAMSUNG SDI AMERICA, INC.'S OPENING MEMORANDUM OF LAW IN SUPPORT OF THEIR PROPOSED CLAIM CONSTRUCTION

Karen L. Pascale (#2903)
YOUNG CONAWAY STARGATT & TAYLOR, LLP
The Brandywine Building
1000 West Street, 17th Floor
Wilmington, DE 19801
(302) 571-6600
kpascale@ycst.com

Attorneys for Optrex America, Inc.

OF COUNSEL:

Richard D. Kelly
Andrew M. Ollis
Alexander E. Gasser
Oblon, Spivak, McClelland, Maier & Neustadt, P.C.
1940 Duke Street
Alexandria, VA 22314
(703) 413-3000

Philip A. Rovner (#3215)
POTTER ANDERSON & CORROON LLP
Hercules Plaza
P.O. Box 951
Wilmington, DE 19899
(302) 984-6000
provner@potteranderson.com

Attorneys for FUJIFILM Corporation and FUJIFILM U.S.A. Inc.

OF COUNSEL:

Lawrence Rosenthal
Ian G. DiBernardo
Stroock & Stroock & Lavan LLP
180 Maiden Lane
New York, NY 10038
(212) 806-5400

Richard L. Horwitz (#2246)
David E. Moore (#3983)
POTTER ANDERSON & CORROON LLP
Hercules Plaza
P.O. Box 951
Wilmington, DE 19899
rhorwitz@potteranderson.com

Attorneys for Samsung SDI Co., Ltd. and Samsung SDI America, Inc.

OF COUNSEL:

Stephen S. Korniczky
Elizabeth L. Brann
Paul, Hastings, Janofsky & Walker LLP
3579 Valley Centre Drive
San Diego, CA 92130
(858) 720-2500

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Elliot Schlam hereby declares that:

1. I offer this declaration in support of the Opening Memorandum on Claim Construction (Markman) of the defendants FUJIFILM Corporation, FUJIFILM U.S.A., Inc., Samsung SDI, Ltd., Samsung SDI America, Inc., and Optrex America Inc. I have been retained as a technical expert in this case, have rendered Expert Reports and have been deposed by Plaintiffs.

I. Qualifications

2. I received a BEE degree in electrical engineering from New York University in 1961, an MSEE from New York University in 1964 and a PhD with a specialty in electrical engineering and solid state physics from New York University in 1966.

3. From 1966 to 1987 I worked at increasing levels of responsibility for the United States Department of Defense at the US Army Research and Development Laboratories at Fort Monmouth, New Jersey where I was responsible for the research, development, technology transfer and application of electronic displays including flat panel (including liquid crystal) and cathode ray tube (CRT) displays and projection and direct view displays for a wide variety of military platforms, including ground based, avionic and sea borne platforms. I was a pioneer in the development of Active Matrix Liquid Crystal Display ("AMLCD") technology (see paragraph 10 below). In the 1980's, I was the Army's key participant in a tri-service avionics display working group that led the incorporation of sunlight-legible AMLCDs into military aircraft and ultimately into civilian aircraft. I also was responsible for developing other technologies including applications of AMLCDs in military and commercial systems.

4. After leaving the United States Government, I served for a year and a half as the Vice President of Sales and Marketing for a domestic flat panel display manufacturing company and have been an independent consultant to the display industry since then. I have provided technical, business and patent advice to leading display companies and law offices in the field of all types of electronic displays, including backlit AMLCD displays.

5. I have been a member of the Society for Information Display ("SID"), the leading organization devoted to information display technology, since the late 1960's. I have served as the Chairman of the SID Manufacturing Subcommittee, and served as Chairman of SID Conferences and as Session Chairman on many occasions. I founded, organized and chaired the SID annual Business Conference and the SID annual Investors Conference and currently serve as the Investors Conference Chairman. I was elected a Fellow of SID in 1981, which SID describes as an honor bestowed to SID members of outstanding qualifications and experience as a scientist or engineer in the field of information display.

6. My technical areas of expertise include all aspects of electronic displays including AMLCDs and their applications. I also have significant knowledge of and experience with other types of optical displays, including CRT and projection displays.

7. I have authored, co-authored or presented over 30 technical papers in journals and technical meetings that include major journals and conferences in various areas of flat panel displays. I currently have five issued patents in the field of flat panel display products and their applications. I have presented more than 10 invited lectures and keynote speeches at conferences on these subjects. I have given expert testimony in several cases including trial testimony in 2007 for the plaintiff in a case in this Court, *LG. Philips LCD Co. v. Tatung Co. et al, Case No.*

1:05- cv-00292-JJF (on behalf of plaintiff, LG Philips). A copy of my *Curriculum Vitae* is attached herewith as Exhibit 1, which includes a list of all of my publications in the last ten years.

II. Technology Overview

8. U.S. Patent Number 5,280,371 (the "'371 Patent") issued on January 18, 1994 on an application filed July 9, 1992 of Richard J. McCartney, Jr., Daniel D. Syroid and Karen E. Jachimowicz and is entitled "Directional Diffuser for a Liquid Crystal Display." Liquid crystal display ("LCD") modules of the type taught in the '371 patent require at least a liquid crystal panel, a backlight for providing light to the liquid crystal panel and one or more of what are referred to in the patent as "directional diffusers." The only application specifically identified in the '371 patent for the disclosed LCD modules is aircraft cockpit displays, where the viewer's position is relatively fixed vertically so that much of the light available at larger viewing angles is wasted, while a wider horizontal viewing angle is desired because the aircraft cockpit display may be viewed by a pilot and a copilot sitting side-by-side. Based on the depositions of the named inventors of the '371 patent, which I reviewed, they were working on cockpit displays for commercial aircraft when the embodiments shown in the '371 Patent were developed.

9. In the 1980's and early 1990's the predominant form of cockpit display was based on CRTs and LCDs. In the case of CRTs, images are created by moving and controlling the intensity of an electron beam, or three beams in the case of a color display, (referred to as a "raster scan") across a surface on which are provided phosphor dots which are selectively activated by the beams. As more particularly discussed below, LCDs create images by the selective opening and closing of liquid crystal pixels to prevent or permit the transmission of light through the pixels. During this period, there were typically two types of CRT and liquid

crystal displays: direct view (where the viewer sees the image on the surface of the CRT or liquid crystal panel), and projection (where the image is projected on a screen which the viewer sees). The fundamental difference between a direct view and projection display is that in a projection display the image is magnified by a lens so that it appears larger for group viewing purposes.

10. A liquid crystal panel consists of two sheets of glass that have liquid crystal material dispersed between them. The panel is divided into discrete pixels each serving as a switch to either permit light from the backlight to pass through it or to prevent the passage of light. There are metallic and dielectric film structures patterned on the insides of the sheets, which form the pairs of facing electrodes which define each pixel, a thin film transistor, which is connected to one of each pair of electrodes and drives the pixel to render it transparent or opaque, and conductors (referred to as address lines) connecting each transistor and the associated other electrode to an edge of the panel for connection to a driving circuit. An image is displayed on the liquid crystal panel by the selective activation of the thin film transistor associated with each pixel. Such liquid crystal panels are referred to as active matrix liquid crystal display ("AMLCD") panels. The pixels are generally arrayed in either: a) a rectilinear fashion with each pixel and subpixel (in a color AMLCD, three subpixels, one red, one green and one blue, comprise a pixel) lined up next to and directly above and below each other, so as to be horizontally and vertically aligned in a grid pattern (see Fig. 12 of the '371 patent); or b) in a so called delta pattern where the subpixels are offset from each other along the horizontal rows. The electrical address lines have to reach each row and column of pixels, starting from the edge of the panel, so spaces are reserved between the pixel rows and to some degree between the columns, to accommodate the grouping of address lines which run the entire length and width of

the panel. The horizontally extending spaces between the rows are typically significantly wider and more pronounced than the vertically extending spaces between the columns (or between adjacent pixels in the case of the delta pattern) since it generally also contains power and other signal lines in addition to the address lines. These spaces are typically blackened for contrast enhancement purposes into a so-called black matrix. The net result is predominant black lines which run horizontally across the panel and thinner black lines extending vertically. These vertical lines are not continuous in the case of a delta pattern liquid crystal panel. Annexed as Exhibit 2 is an enlarged photograph of a portion of a typical delta pattern liquid crystal panel showing the pixels, the transistors, the thick horizontal black lines and the thinner vertical black lines.

11. Liquid crystal panels do not create light, as do CRTs, and therefore a backlight is generally required. The backlight is generally limited in total light output, while a typical liquid crystal panel only transmits three to five percent of the light applied to it. The light that the viewer sees can be scattered in many directions, resulting in a display that does not appear bright enough for many applications. To increase the perceived brightness without increasing the total amount of light (and therefore the required energy) in the system, one or more lens arrays can be added to a liquid crystal module to narrow the scattering of the light to angles where the viewer is expected to be, since light going elsewhere is wasted. Although the total amount of light produced does not change, the lens arrays concentrate the light into limited viewing angles, therefore making the display appear brighter to the viewer. The increased brightness which the viewer sees with a lens array is referred to as "gain." This principle is applicable to both direct view and projection liquid crystal displays. For example, in the 1980's rear projection screens had been modified so that they generally did not transmit much light at high or low vertical

angles because one does not expect the viewer's eyes to be physically higher or lower than the screen; however, to allow for a number of people viewing the screen at the same time, it was desired that the horizontal viewing angle be wider. The same effect was desired for LCDs for use in a cockpit; for example, where one does not expect the pilot's and co-pilot's eyes to be substantially higher or lower than a predetermined level, but because they are sitting side-by-side, the horizontal viewing angle should be greater.

12. In the 1980's in the projection display case, the widening and narrowing of appropriate viewing angles had been achieved through the use of lens arrays such as lenticular arrays and Fresnel lens arrays, which generally change the pathways of the many divergent light rays. Both lenticular arrays and Fresnel lens arrays are typically in the form of thin sheets each having a series of lenslets aligned on one surface; but a Fresnel lens array differs from a lenticular array in that the Fresnel lens array is designed with each lenslet having a different shape so as to mimic the performance of a conventional convex or concave lens. In a rear projection display, the optical elements are incorporated as part of the projection screen since it is that element of the display that directs the light (image) so that it can be viewed within prescribed viewing angle ranges. Similar effects can be achieved in direct view displays, but the optical elements are generally incorporated between the backlight and the liquid crystal panel since it is the backlight of the display apparatus that creates much of the scattering of light. In both the projector and direct view cases, the optical elements direct light into predefined viewing angles. Whether these elements are in a projection screen or between the backlight and the liquid crystal panel of a direct view display does not materially affect their mode of operation; they operate according to the same principles to direct light.

13. In the '371 patent the backlight 25 consists of a serpentine-shaped fluorescent lamp 10 inside a reflector box 15 with a diffuser 20 defining the output of the backlight (a "diffuser" is an optical element that tends to distribute light, ideally, so that it is uniform at all viewing angles). Backlight 25 serves as the light source for the liquid crystal modules of its '371 patent.

14. For every pixel of the liquid crystal panel to function, light must be applied to all of them. Therefore, the light from the light source must be distributed across the surface of the liquid crystal panel in the embodiments shown and described in the '371 patent, the light source achieves this distribution of light by use of lambertian diffuser 20. However, I believe that use of a lambertian diffuser is not part of the definition of "light source" since a person of ordinary skill in the art would know that a distributed source of light could be achieved in other ways, for example by use of a side or edge-lit light guide. Where a thinner display is desired, it was known prior to the filing of the application for the '371 patent and Honeywell's alleged early invention date (February 8, 1990) to provide a side or edge-lit backlight for liquid crystal displays . In general, such side or edge-lit backlights included a backlight assembly that consisted of a lamp or lamps, a light guide (typically a light wedge due to its triangular profile but it can have a rectangular profile) to redirect the light from the lamp or lamps in a direction toward the liquid crystal panel, and, usually, a reflector. For example, a lamp located along the thin surface of a wedge-shaped light guide on its edge or side emits light into the guide in a first direction, the light is internally reflected by the other surfaces of the light guide, including a second surface (typically of the hypotenuse of the triangular cross section) or a reflector behind the second surface, and then emitted from a third surface of the guide in a second direction approximately normal to the surface of the liquid crystal panel. In effect the light guide serves to redirect the light from the lamp or lamps located on a side so that the light emitted by the third

surface is distributed across the third surface so as to illuminate the entire liquid crystal panel. In recent years the lamp or lamps were frequently replaced by light emitting diodes ("LEDs"). A lamp or LED in a side-lit backlight cannot, without the light guide, illuminate the surface of the liquid crystal panel.

15. An example of a side or edge-lit display taken from IBM Technical Bulletin, Vol. 33, No. 1B (June 1990), a copy of which is annexed as Exhibit 3, is shown below:

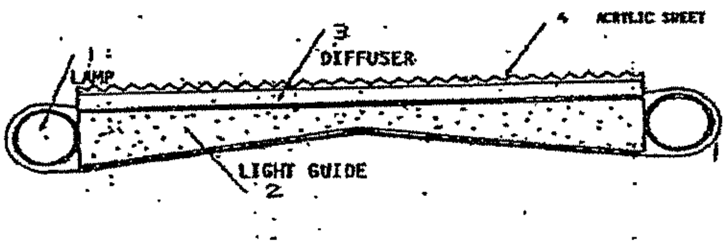


Fig. 1

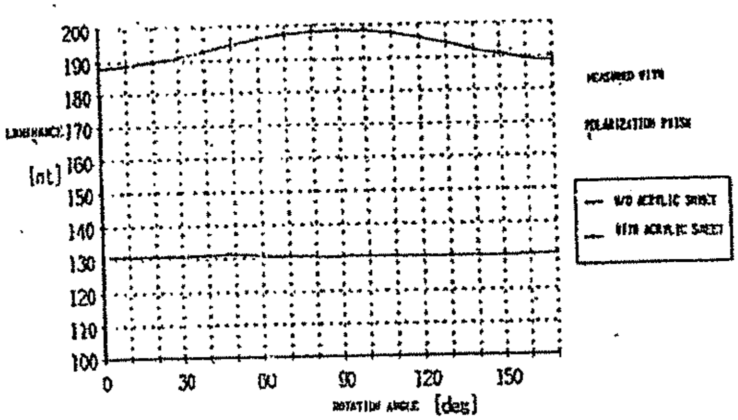
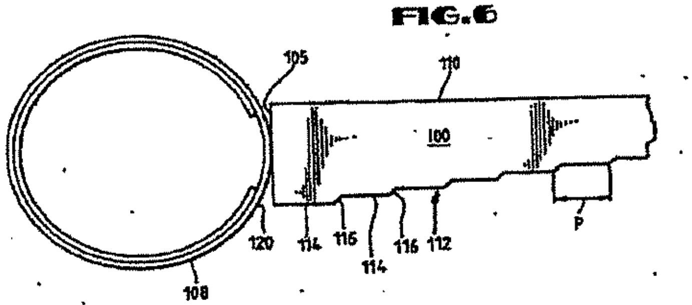


Fig. 2

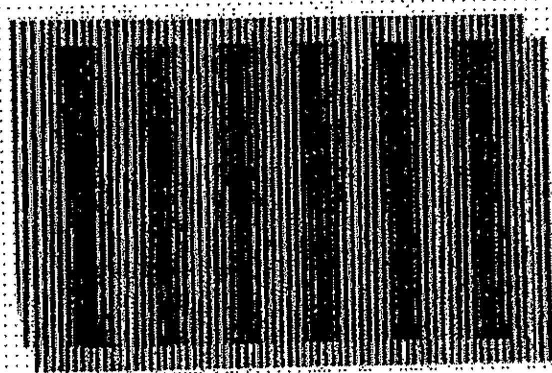
In Fig. 1, acrylic sheet 4 is a lens array which narrows the viewing angle of the light from the light source (lamp 1, light guide 2 and diffuser 3) headed in the direction of a liquid crystal panel (not shown) above the acrylic sheet 4 to produce a gain in luminance in a relatively narrow viewing angle represented by the different between luminance with and without the acrylic sheet as shown in Fig. 2. Instead of relying solely on the shape of the light guide, various structures on the second or third surfaces of the light guide can be provided to aid in the creation of a distributed source of light. An example is shown below, taken from U.S. Patent No. 5,056,946 (Hathaway et al.), a copy of which is annexed as Exhibit 4, where light from lamp 108 is applied to a wedge-shaped light guide 100, which has facets 116 on its bottom surface.

FIG. 6



16. The claims of the '371 patent are all directed to LCD modules which include structures for eliminating or reducing moiré interference. Moiré interference (usually referred to as "moiré") is the appearance of visible bands when two repetitive patterns that have a physical similarity to each other are visibly superimposed over each other. The relationship may involve two identical patterns with a slight offset with respect to each other. It may also involve two non-identical patterns that have periodicities that are almost the same or unit integer (i.e., 1, 2, 3, 4 ...) multiples of each other and are aligned with each other. Patterns that do not closely align will not normally create moiré interference. Most people have observed moiré interference,

although they may not know it by name. For example, moiré interference is sometimes visible when a repetitive pattern in a scene in a movie is played over a television set whose screen has a repetitive pattern, albeit one usually not visible (for example, a set of horizontally extending raster scan lines or pixel boundaries). An example of moiré is reproduced below, taken from Oster et al., "Moiré Patterns," Scientific American, May 1963 at 54-63:



There are mathematical equations which can be used to predict the existence of moiré interference, one factor of which is relative angle. To avoid moiré interference most workers in the art used a trial and error approach until the moiré interference is reduced to the extent required. Complete elimination of moiré interference is very difficult but in most systems there is a level of moiré interference which is not observable by the viewer and which can be tolerated. Moiré interference is a well-known optical phenomenon which has to be overcome in the design of many optical systems. Several techniques were developed before the filing date of the '371 patent or the earliest claimed reduction to practice date to reduce moiré interference, including: a) the use of a diffuser between the viewer and the source of moiré interference to blur interference; b) changes in pitch of one or more of the repetitive patterns to avoid one repetitive pattern having a pitch which is integer multiple of another overlapping pattern; and c) rotation of one of the repetitive patterns relative to the other.

17. Since moiré interference is the result of repetitive patterns which are visibly superimposed over each other and have a physical similarity to each other, from a physics and optics point of view, the cause of moiré interference in various structures is the same. What differs is the nature and source of the repetitive patterns. Before the filing date of the '371 patent or the earliest claimed reduction to practice date, moiré interference had been experienced in a wide variety of commercial situations, including direct view CRT and LCD displays, projection CRT and LCD displays, color printing using half tone images and fabric weaving. In each of these cases one or more of the three solutions (diffusion, non-integer relative pitch selection and rotation of one repetitive pattern relative to the other) have been used to solve the problem of moiré interference. Moiré interference is moiré interference, no matter where it appears or by what structure or image causes it.

18. The '371 patent in Fig. 7 (reproduced below)

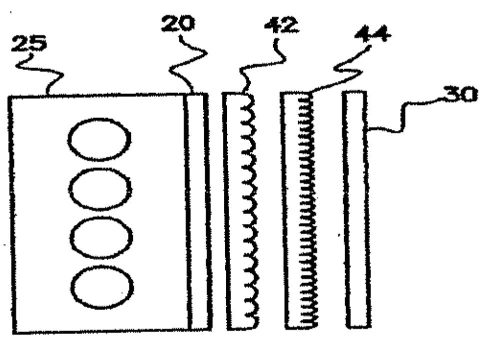


Fig. 7

and at column 4, line 26-column 5, line 5, shows and describes an LCD module with two lens arrays 42, 44 separate from the light source 15, where the cylindrical lenslets on each lens array: a) extend parallel to each other and to the horizontal axis of the liquid crystal panel; b) face the

liquid crystal panel; c) have different pitches; and d) together, create a predetermined variation in vertical viewing angle. Specifically, the specification of the '371 patent states:

> For the desired specific implementation it was discovered that the adverse interaction producing moiré patterns could be eliminated by including a second lens array with a different number of lenses per inch. The combination of the dual lenses increased the desired reduction in luminance with increased viewing angle, and in addition reduced or eliminated the moiré patterns with the selection of an appropriate pitch, or number of lenses per inch, for the two lenses in question.
>
> As illustrated in Fig. 7, one of the lens arrays 42 was selected to have a relatively course pitch with respect to that of the liquid crystal display and the second lens array 44 was selected to have a relatively fine pitch with respect to that of liquid crystal display.
>
> ...
>
> In addition, since moire effects result when both of the lens arrays have the same spatial frequency, the rear array 42 should have a coarse resolution or low spatial frequency while the front lens array 44 should have a fine resolution or high spatial frequency. The lens arrays and the panel spatial frequencies should be selected to avoid integral multiples of the other. ...

Column 4, lines 26-65. Thus, the '371 patent teaches that the purpose of the second lens array is to both increase the desired reduction in luminance with increased viewing angle and to reduce or eliminate moiré. The former purpose is illustrated by comparing the luminance vs. viewing angle charts of Fig. 5 (where a single lens array is used as shown in Fig. 2) and Fig. 8 (where the two lens arrays are used as shown in Fig. 7), below:

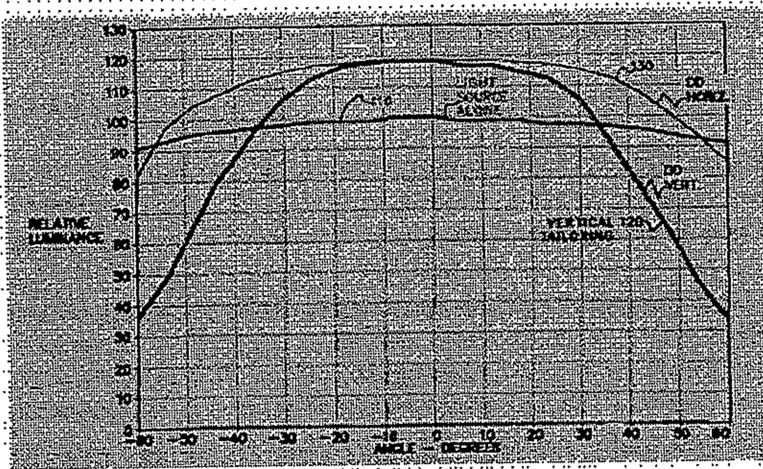


FIG. 5

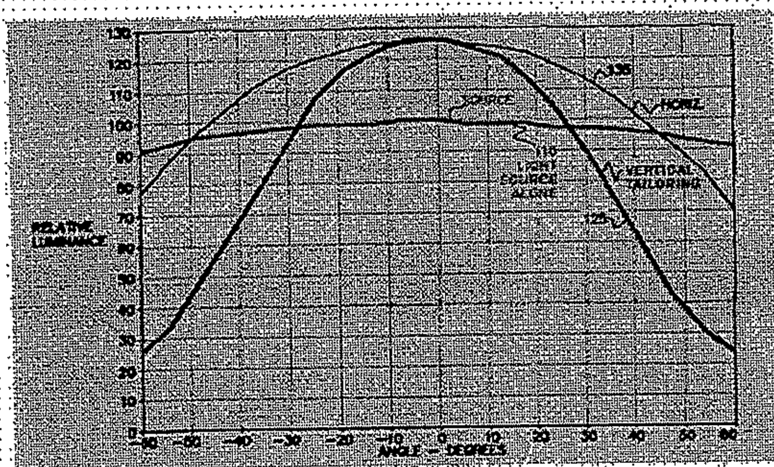


FIG. 8

The relative luminance vs. vertical viewing angle curve 125 of Fig. 8 has a higher peak (indicating increased gain) and is narrower (indicating decreased viewing angle) than the corresponding curve in Fig. 5. This increased gain and constricted viewing angle is only possible if the two lens arrays extend essentially parallel to each other and to the horizontal axis of the liquid crystal panel and face the liquid crystal panel. As for reduction in moiré interference, the '371 patent teaches that moiré interference is eliminated if the two lens arrays

have relative spatial frequencies (frequency is inversely related to pitch) which are each "selected to avoid integral multiples of the other." Column 4, line 59-column 5, line 5. Since moiré interference is created where there are two overlapping repetitive patterns which extend in essentially the same direction, of necessity, for moiré interference to potentially exist at all and therefore require steps to eliminate it, the two lens arrays and the horizontal axis of the liquid crystal panel must extend essentially parallel to each other.

III. Construction of LCD Modules in the FUJIFILM Defendants Digital Still Cameras

1. General Overview

19. I also have been provided for analysis representative samples of LCD modules which, I was advised, were assembled by FUJIFILM Corporation ("Fuji") for sale in the United States and incorporated into its digital still cameras ("DSC"), designated Types a-c and e. I am advised that the Type d Fuji LCD module, which I also examined, is not accused of infringement of the '371 patent and I will not discuss it here. For each sample provided, I disassembled the LCD module, and I photographed the components using a laboratory microscope equipped with a digital camera. For each sample LCD module that I photographed, I first disassembled it. Next, I would lay out the disassembled components in the appropriate order. Once the components were disassembled, I photographed both sides of the light guide and the lens sheet or sheets. I pieced the representative photographs into a composite photograph. I also photographed the liquid crystal panels. By reason of this investigation, I became familiar with and can recognize the structures of the Types a-c and e Fuji LCD modules.

20. Exhibits 5 (Type a), 6 (Type b), 7 (Type c) and 8 (Type e) are schematics illustrating the construction of each of the four accused types of Fuji modules. I have reviewed these

schematics and they are consistent with my observations, as described in greater detail below, except that they are not to scale. For example, the lenslets on each lens array and some of the light guides are greatly exaggerated to permit viewing of the orientation of the projections.

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2. LCD Module Type a (Exhibit 5)

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3. LCD Module Type b (Exhibit 6)

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4. LCD Module Type c (Exhibit 7)

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5. **LCD Module Type e (Exhibit 8)**

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IV. Honeywell's Early Reduction to Practice Claims

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47. Very different optical effects are produced, depending on the direction in which the lenslets face. Nowhere in the '371 patent is there any suggestion of using a lens array to increase both horizontal viewing angle and to sacrifice gain. But Messrs. McCartney and Syroid authored an article published in October, 1992, after the filing of the application for the '371 patent in

which they stated that "flipping the lens array over such that the curved lens surface faces the diffuser" results in a widening the viewing angle at the expense of reduced gain. McCartney, Syroid, Directional Diffuser Lens Array for Backlit LCDs, Japan Display '92 at 260. A true copy of the article is annexed as Exhibit 11.

48.

REDACTED

49.

REDACTED

REDACTED

I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Dated: April 25, 2008

Elliott Schlam

NY 71416986v1

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF DELAWARE

CERTIFICATE OF SERVICE

I, Philip A. Rovner, hereby certify that, on May 2, 2008, the within document was electronically filed with the Clerk of the Court using CM-ECF which will send notification of such filing to the following; that the document was served on the following counsel as indicated; and the document is available for viewing and downloading from CM-ECF:

BY E-MAIL AND HAND DELIVERY

Thomas C. Grimm, Esq.
Benjamin J. Schladweiler, Esq.
Morris, Nichols, Arsht & Tunnell
1201 N. Market Street
P.O. Box 1347
Wilmington, DE 19899-1347
tgrimm@mnat.com
bschladweiler@mnat.com

Karen L. Pascale, Esq.
Young, Conaway, Stargatt & Taylor, LLP
The Brandywine Bldg., 17th Fl.
1000 West Street
Wilmington, DE 19801
kpascale@ycst.com

Matthew Neiderman, Esq.
Duane Morris LLP
1100 N. Market Street
Suite 1200
Wilmington, DE 19801
mneiderman@duanemorris.com

BY E-MAIL AND HAND DELIVERY

Richard L. Horwitz, Esq.
David E. Moore, Esq.
Potter Anderson & Corroon LLP
Hercules Plaza
P.O. Box 951
Wilmington, DE 19899
rhorwitz@potteranderson.com
dmoore@potteranderson.com

David J. Margules, Esq.
Bouchard Margules & Friedlander, P.A.
222 Delaware Avenue, Suite 1400
Wilmington, DE 19801
dmargules@bmf-law.com

/s/ Philip A. Rovner
Philip A. Rovner (#3215)
Potter Anderson & Corroon LLP
Hercules Plaza
P.O. Box 951
Wilmington, DE 19899
(302) 984-6000
E-mail: provner@potteranderson.com